

Claims

1. A lead frame substrate, comprising:

a plurality of connection bars;

5 a semiconductor die pad being adapted to receive a semiconductor die;

a plurality of termination pads being linked together and to said semiconductor die pad by said plurality of connection bars, each one of said plurality of termination pads being adapted to receive a passive component and a bonding wire; and

10 a molding compound fixing said semiconductor die pad, said plurality of termination pads, and said plurality of connection bars together.

2. The lead frame substrate according to claim 1, wherein said semiconductor die pad, said plurality of termination pads, and said plurality of connection bars comprise a thermally and electrically conductive material.

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3. The lead frame substrate according to claim 2, wherein said thermally and electrically conductive material comprises copper.

4. The lead frame substrate according to claim 1, wherein said semiconductor die pad, said plurality of termination pads, and said plurality of connection bars include a top and bottom surface.

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5. The lead frame substrate according to claim 4, wherein said molding compound leaves said top and bottom surfaces uncovered.

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6. The lead frame substrate according to claim 1, wherein said semiconductor die pad, said plurality of termination pads, and said plurality of connection bars have a unitary construction from a common piece of material.

7. The lead frame substrate according to claim 1, further comprising a plurality of leads located around a periphery of the lead frame substrate.

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8. The lead frame substrate according to claim 1, wherein said plurality of connection bars electrically couple said semiconductor die pad to said plurality of termination pads.
- 5 9. The lead frame substrate according to claim 1, wherein said plurality of connection bars electrically couples said plurality of termination pads together.
- 10 10. The lead frame substrate according to claim 1, wherein said plurality of connection bars comprises permanent connection bars and temporary connection bars.
- 11 11. The lead frame substrate according to claim 10, wherein said temporary connection bars are removed from the lead frame substrate prior to mounting the lead frame substrate on a lead frame.
- 15 12. The lead frame substrate according to claim 1, wherein the lead frame substrate comprises a substantially uniform thickness.
13. The lead frame substrate according to claim 1, wherein the lead frame substrate is adapted for being mounted to a circuit board.
- 20 14. The lead frame substrate according to claim 13, wherein only said semiconductor die pad and said plurality of leads contact the circuit board when the lead frame substrate is mounted on the circuit board.
- 25 15. A lead frame package, comprising:
a housing having a central portion and a plurality of leads located around a periphery of said housing; and
a lead frame substrate mounted on said central portion, said lead frame substrate being electrically coupled to at least one of said plurality of leads and including:
a plurality of connection bars;
30 a semiconductor die pad being adapted to receive a semiconductor die;
a plurality of termination pads, each one of said plurality of termination pads being adapted to receive a passive component and a bonding wire,

said plurality of termination pads being linked together and to said semiconductor die pad by said plurality of connection bars; and

a molding compound fixing said semiconductor die pad, said plurality of termination pads, and said plurality of connection bars together.

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16. The lead frame package according to claim 15, wherein said plurality of connection bars, said semiconductor die pad, and said plurality of termination pads have a unitary construction from a common sheet of conductive material.

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17. The lead frame package according to claim 16, wherein said sheet of material comprises copper.

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18. The lead frame package according to claim 15, wherein said plurality of connection bars electrically couples said plurality of terminations pads together and said semiconductor die pad to said plurality of termination pads.

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19. The lead frame package according to claim 15, wherein said plurality of connection bars comprises a combination of permanent connection bars and a plurality of temporary connection bars.

20. The lead frame package according to claim 19, wherein said temporary connection bars are removed from said lead frame substrate prior to mounting said lead frame substrate on said central portion.

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21. The lead frame package according to claim 15, wherein said semiconductor die pad, said plurality of termination pads, and said plurality of connection bars include a top and bottom surface.

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22. The lead frame package according to claim 21, wherein said molding compound leaves said top and bottom surfaces uncovered.

23. The lead frame package according to claim 21, further comprising a packaging material, said packaging material encapsulates said top surface of each one of said plurality of connections bars, of said semiconductor die pad, of each one of said plurality of termination pads, and said molding compound.

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24. The lead frame package according to claim 15, wherein said lead frame substrate comprises a substantially uniform thickness.

25. A lead frame package, comprising:

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a housing having a central portion and a plurality of leads located around a periphery of said housing;

a lead frame substrate mounted on said central portion, said lead frame substrate being electrically coupled to at least one of said plurality of leads and including:

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a plurality of semiconductor die pads, each one of said plurality of semiconductor dies pads being adapted to receive a semiconductor die;

a plurality of termination pads, each one of said plurality of termination pads being adapted to receive a passive component and a bonding wire,

a plurality of connection bars linking together said plurality of termination pads and said semiconductor die pad; and

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a molding compound applied to said lead frame substrate, said molding compound fixing said plurality of semiconductor die pads, said plurality of termination pads, and said plurality of connection bars together.

26. The lead frame package according to claim 25, wherein said lead frame substrate comprises a unitary construction from a common sheet of conductive material.

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27. The lead frame package according to claim 26, wherein said sheet of material comprises copper.

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28. The lead frame package according to claim 25, wherein said housing comprises a plastic material.

29. The lead frame package according to claim 25, wherein each one of said plurality of semiconductor die pads, each one of said plurality of termination pads, and each one of said plurality of connection bars includes a top and bottom surface.
- 5 30. The lead frame package according to claim 29, wherein said molding compound leaves said top and bottom surfaces uncovered.
31. The lead frame package according to claim 25, wherein said plurality of connection bars comprises a plurality of temporary connection bars and a plurality of permanent connection bars.
- 10 32. The lead frame package according to claim 31, wherein said temporary connection bars fix said plurality of termination pads in position relative to each other.
- 15 33. The lead frame package according to claim 25, wherein said lead frame substrate further comprises a plurality of leads located around a periphery of the said lead frame substrate.
- 20 34. The lead frame package according to claim 33, wherein said molding compound fixes said plurality of leads in said molding compound.
35. A lead frame substrate for mounting onto a circuit board, comprising:
a plurality of leads located about a periphery of the lead frame substrate;
a plurality of connection bars;
25 a plurality of semiconductor die pads, each one of said plurality of semiconductor die pads being adapted to receive a semiconductor die;
a plurality of termination pads, each one of said plurality of termination pads being adapted to receive a passive component and a bonding wire, said plurality of termination pads being linked together and to said plurality of semiconductor die pads by
30 said plurality of connection bars; and

a molding compound fixing said plurality of semiconductor die pads, said plurality of termination pads, said plurality of connection bars, and said plurality of leads together.

5 36. The lead frame substrate according to claim 35, wherein only said plurality of semiconductor die pads and said plurality of leads contact the circuit board when the lead frame substrate is mounted on the circuit board.

10 37. The lead frame substrate according to claim 35, wherein said plurality of connection bars electrically couple said plurality of semiconductor die pads to said plurality of terminations pads.

15 38 The lead frame substrate according to claim 35, wherein the lead frame substrate comprises a substantially uniform thickness.

39. The lead frame substrate according to claim 35, wherein said frame, said plurality of connection bars, said plurality of semiconductor die pads, and said plurality of termination pads have a unitary construction from a common piece of conductive material.

20 40. A lead frame package, comprising:
 a circuit board having a top surface including electrically conductive and electrically non-conductive portions; and
 a lead frame substrate mounted on said top surface of said circuit board, including:

25 a plurality of leads located about a periphery of said lead frame substrate;

 a plurality of connection bars;

 a semiconductor die pad being adapted to receive a semiconductor die;

30 a plurality of termination pads, each one of said plurality of termination pads being adapted to receive a passive component and a bonding wire, said plurality of termination pads being linked together and to said semiconductor die pad by said plurality of connection bars; and

a molding compound fixing said semiconductor die pad, said plurality of termination pads, said plurality of connection bars, and said plurality of leads together.

5 41. The lead frame package according to claim 40, wherein said plurality of leads and said semiconductor die pad are electrically coupled to said conductive portions of said circuit board.

10 42. A method for manufacturing a lead frame substrate, the lead frame substrate being configured to receive semiconductor dice and discrete passive components, the method comprising the steps of:

15 (a) forming a lead frame substrate in a sheet of conductive material, the lead frame substrate including at least one semiconductor die pad, a plurality of termination pads, and a plurality of temporary and permanent connection bars that link the semiconductor die pads and plurality of termination pads together;

 (b) applying a molding compound to the lead frame substrate formed in said step (a), the molding compound fixing the semiconductor die pads, the plurality of termination pads, and the plurality of temporary and permanent connection bars together; and

20 (c) removing the plurality of temporary connection bars from the lead frame substrate.

43. The method according to claim 42, wherein forming the lead frame substrate in said step (a) is accomplished by a stamping process.

25 44. The method according to claim 42, wherein forming the lead frame substrate in said step (a) is accomplished by an etching process.

45. The method according to claim 42, wherein removing the plurality of temporary connection bars in said step (c) is accomplished by a stamping process.

30 46. The method according to claim 42, wherein removing the plurality of temporary connection bars in said step (c) is accomplished by an etching process.

47. The method according to claim 42, wherein removing the plurality of temporary connection bars in said step (c) is accomplished by a laser cutting process.

5 48. The method according to claim 42, wherein removing the plurality of temporary connection bars in said step (c) is accomplished by a milling process.

49. A method for mounting semiconductor components on a lead frame substrate, comprising the steps of:

- 10 (a) forming a plurality of lead frame substrates into a sheet of conductive material, each one of the plurality of lead frame substrates includes at least one semiconductor die pad and a plurality of termination pads linked together by a plurality of temporary connection bars and a plurality of permanent connection bars;
- (b) applying a molding compound to each one of the plurality of lead
- 15 frame substrates formed in said step (a);
- (c) removing the plurality of temporary connection bars from each lead frame substrate;
- (d) applying adhesive tape to the back side of each lead frame substrate;
- (e) mounting discrete passive components on the termination pads;
- 20 (f) mounting a semiconductor die on each semiconductor die pad;
- (g) producing bonding connections; and
- (h) applying a packaging material over each lead frame substrate formed in said step (a), the packaging material encasing the discrete passive components mounted in said step (e), the semiconductor dice mounted in said step (f), and the bonding connections
- 25 produced in said step (g).

50. The method according to claim 49, further comprising:

- (i) separating the sheet of material into individual units, each one of the individual units containing a lead frame substrate.

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51. The method according to claim 49, wherein each lead frame substrate formed in said step (a) is accomplished by a stamping process.

52. The method according to claim 49, wherein removing the plurality of temporary connection bars in said step (c) is accomplished by an etching process.

5 53. The method according to claim 49, wherein removing the plurality of temporary connection bars in said step (c) is accomplished by a laser cutting process.

54. The method according to claim 49, wherein removing the plurality of temporary connection bars in said step (c) is accomplished by a milling process.

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55. The method according to claim 49, wherein applying the molding compound in said step (b) further comprises fixing the semiconductor die pads, the plurality of termination pads, the plurality of temporary connection bars, and the plurality of permanent connection bars in the molding compound.

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56. The method according to claim 49, wherein each lead frame substrate formed in said step (a) is accomplished by an etching process.

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57. A method for mounting semiconductor components on a lead frame substrate, comprising the steps of:

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(a) forming a plurality of lead frame substrates into a sheet of material, each one of the plurality of lead frame substrates including at least one semiconductor die pad and a plurality of termination pads, the semiconductor die pad and the plurality of termination pads being linked together by a plurality of temporary connection bars and a plurality of permanent connection bars;

(b) applying a molding compound to each one of the plurality of lead frames substrates formed in said step (a);

(c) applying adhesive tape to the backside of each lead frame substrate;

(d) mounting discrete passive components on the termination pads;

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(e) mounting a semiconductor die on each semiconductor die pad;

(f) producing bonding connections;

(g) applying a packaging material over each lead frame substrate formed in said step (a), the packaging material encasing the discrete passive components mounted in said step (e), the semiconductor dice mounted in said step (f), and the bonding connections produced in said step (g);

5 (h) removing the adhesive tape that was applied in said step (c); and

(i) applying an etching process to the backside of each lead frame substrate to remove the plurality of temporary connection bars.

10 58. A method for manufacturing a lead frame substrate, the lead frame substrate being configured to receive semiconductor dice and discrete passive components, the method comprising the steps of:

15 (a) forming a lead frame substrate in a sheet of material, the lead frame substrate including at least one semiconductor die pad, a plurality of termination pads, a plurality of temporary and permanent connection bars that link the semiconductor die pads and plurality of termination pads together, and a plurality of permanent and temporary leads;

(b) applying a molding compound to the lead frame substrate formed in said step (a), the molding compound fixing the semiconductor die pads, the plurality of termination pads, the plurality of temporary and permanent connection bars, and the plurality of permanent and temporary leads together; and

20 (c) removing the plurality of temporary connection bars and temporary leads from the lead frame substrate.

25 59. The method according to claim 58, wherein forming the lead frame substrate in said step (a) creates semiconductor die pads and permanent leads that are thicker than the termination pads, the temporary connection bars, and the temporary leads.

60. The method according to claim 58, wherein the plurality of permanent and temporary leads are located about a periphery of the lead frame substrate formed in said step (a).